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## Echocardiographic Findings of Renal Cell Carcinoma Extending into the Right Atrium via the Inferior Vena Cava

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### Abstract

We encountered a 60-year-old female with Grawitz's tumor (hypernephroma) that extended into the right atrium and right ventricle via the inferior vena cava. At the first operation, a tumor originating in the right kidney was resected en bloc, but the metastatic tumor extending into the inferior vena cava and right atrium could not be removed. This tumor was observed echocardiographically for two years postoperatively until the patient died of pulmonary aspergillosis. This paper describes the changes in the echocardiographic findings of this patient.

### Introduction

In approximately 5 per cent of the reported nephrectomies for renal cell carcinoma, the inferior vena cava is involved by direct vascular tumor thrombus extension<sup>3)</sup>. The incidence of extension into the right atrium in these patients ranges from 14 to 41 per cent<sup>1,5,7)</sup>.

We encountered a case in which Grawitz's tumor extended into the right atrium and right ventricle via the inferior vena cava. We present the echocardiographic findings of this patient.

### Report of a Case

A 60-year-old female had been healthy until the beginning of June, 1981, when she experienced slight edema in the legs, which increased on exertion; she was effectively treated with diuretics. One month later, the patient suffered from discomfort in the right hypochondrial region, poor appetite, general malaise and dyspnea on exertion. Upon admission on July 25, 1981, an elastic hard tumor (5×9 cm) with an irregular surface and sharp margin was palpable below the right costal margin. The liver was palpable below the xyphoid process, but the spleen and left kidney were not palpable. CT scan showed an abnormal mass (approximately 8 cm in diameter) above the right kidney. The renal vein and inferior vena cava were observed with tumor thrombus. The portal and hepatic veins were dilated. Chest CT scan revealed a sub-

Key words: Renal cell carcinoma, Extension, Tumor thrombus, Echocardiography, Right atrium.

索引語: 腎細胞癌, 伸展, 腫瘍血栓, エコー法, 右心房.

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pleural shadow in the right middle lobe of the lung, strongly suggesting metastatic tumor. Two-dimensional echocardiography (Toshiba SSH-11A, 2.25 MHz transducer) revealed a tumor protruding into the right atrium from the inferior vena cava. The other cardiac findings were within normal limits.

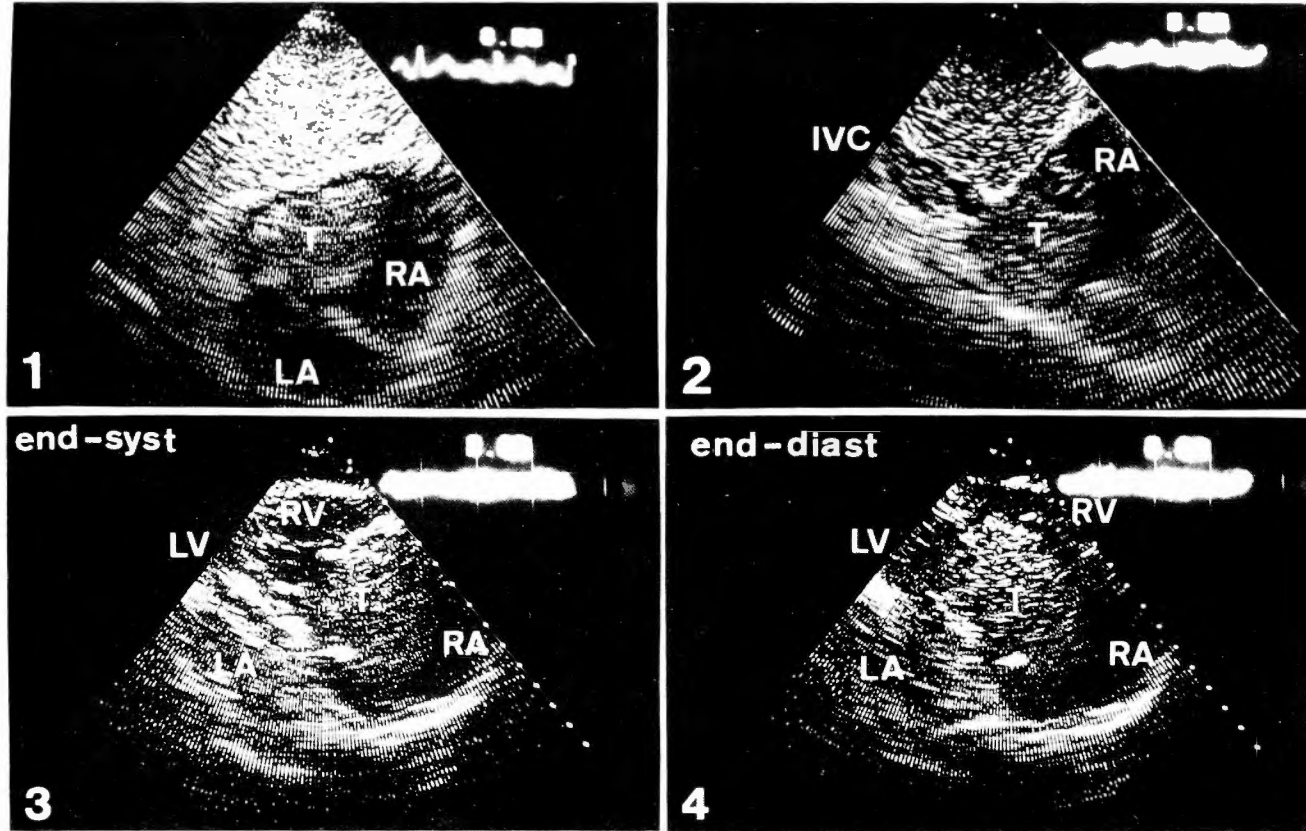
On August 12, 1981, the tumor and right kidney, which were indistinguishable, were resected; the combined mass ( $7 \times 9 \times 15$  cm) weighed 450 g. No metastasis to the liver or peritoneal dissemination was noted. After resection of the tumor, inferior vena cava involvement was observed from the orifice of the divided right renal vein. The tumor was attached to the intima of the inferior vena cava, resulting in obstruction of blood flow. Thus, stripping of the tumor thrombus was impossible due to the risk of pulmonary embolism. The left renal vein, was also occluded by the tumor. Anticancer emulsion was injected into the adjacent lymph nodes and occluded inferior vena cava.

Postoperative course was uneventful and the patient was discharged on September 12, 1981. A follow-up echocardiographic examination one month later, revealed an intracardiac tumor extending into the right ventricle through the right atrium (Figs. 1 and 2). Changes in size of the intracardiac tumor, were observed echocardiographically every 2–3 months. The size of the tumor was maximal on August 5, 1982 (Fig. 3), and thereafter decreased (fig. 4). Subsequent echocardiography showed moderate pericardial effusion with an anterior free space of 10 mm. At this time low cardiac output syndrome clinically appeared. One month later, both pleural effusion and leg edema disappeared. However, a new tumor ( $3.0 \times 3.5$  cm) on the left renal pole was detected by CT scan, on September 7, 1982. The new tumor gradually enlarged, whereas the intracardiac tumor showed no change.

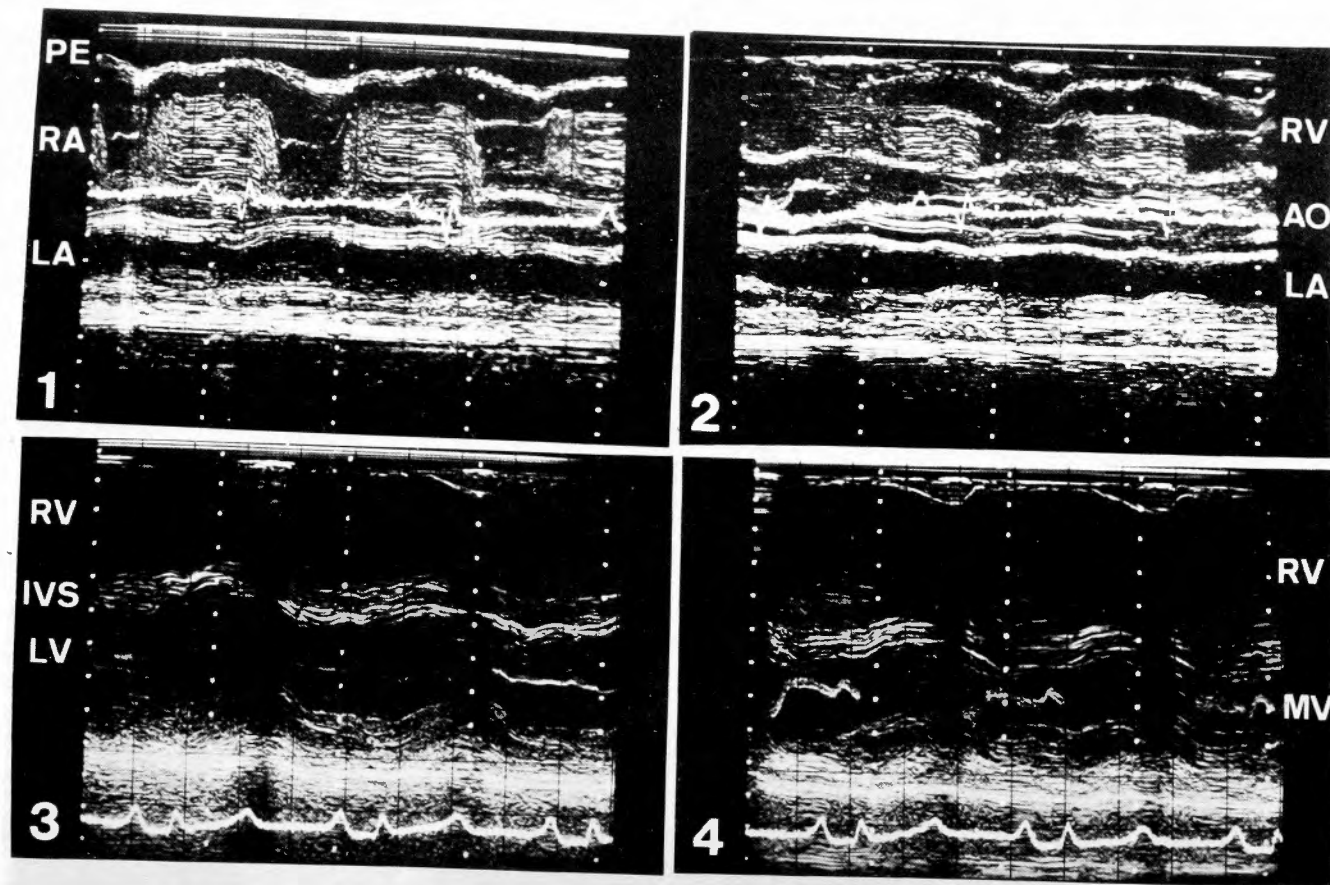
Reoperation was performed on February 25, 1983. The abdominal tumor occupied the region bordered by the tail of the pancreas, the abdominal aorta, and the upper pole of the left kidney. Total resection of the tumor was not possible because of the patient's general condition. Puncture of the cystic central portion of the tumor yielded a dark red fluid, suggestive of central necrosis. The encapsulated tumor was incised and as much of the tissue as possible was removed. Anticancer emulsion was injected into the remaining tumor and adjacent lymph nodes. Interestingly, no recurrence of the tumor was found near the area previously occupied by the right kidney or the inferior vena cava.

Because of renal failure, dialysis was started on June 1, 1983, with daily urination of 300 ml. One week later, urination increased to more than 1000 ml a day. However, she died of respiratory failure on July 2. Autopsy revealed that the pulmonary lesions diagnosed as a metastatic tumor were foci of aspergillosis. The left kidney was encompassed by Grawitz's tumor. Liver metastasis was also noted.

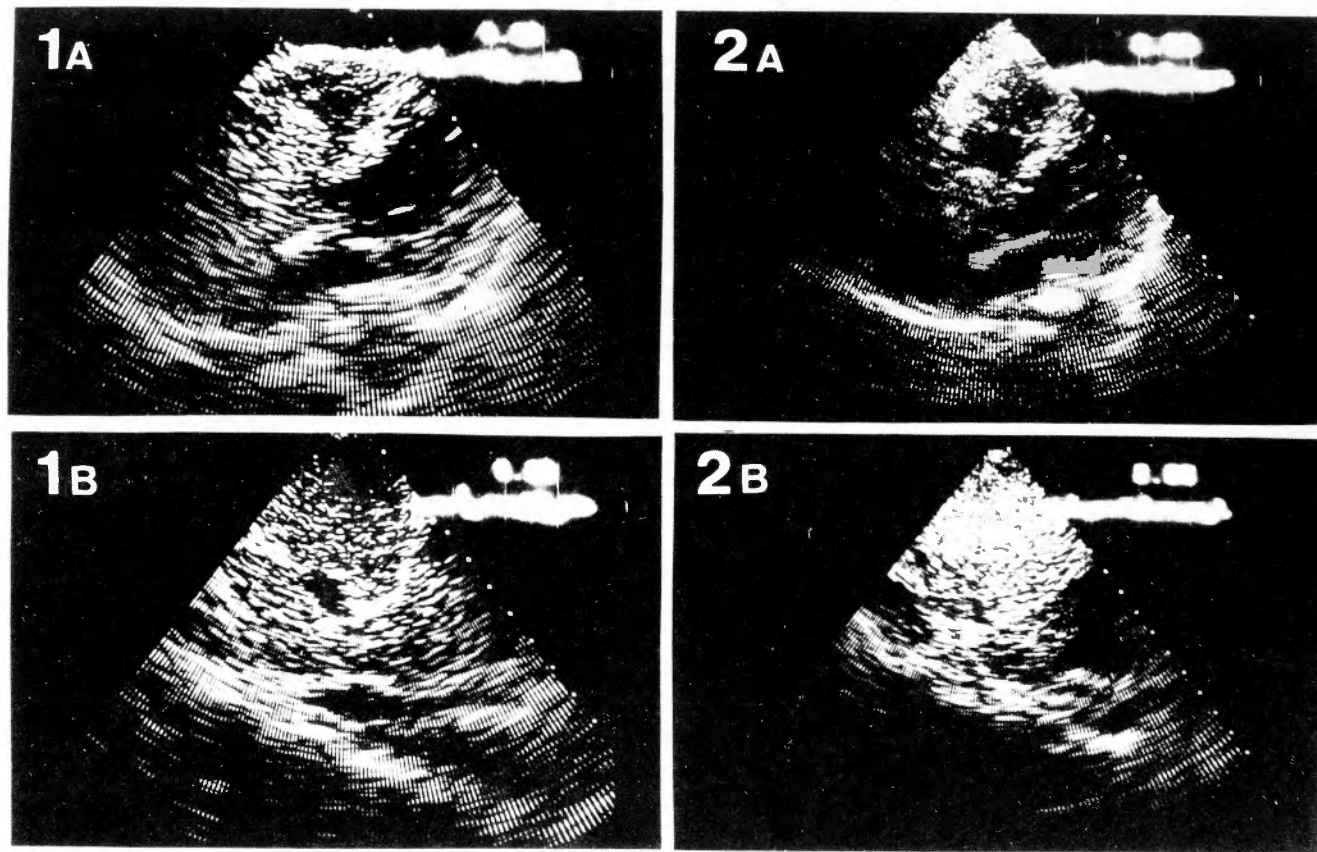
The intracardiac tumor entering into the right ventricle through the tricuspid valve caused dilatation of the right ventricle and pericardial effusion, which in turn, resulted in paradoxical movement of the interventricular septum and low cardiac output syndrome. Tumor echo was similar to that seen in myxoma; however, the echo strength of the encapsulated surface was more intensive. The motion of the tumor resembled that of myxoma despite the absence of stalk.



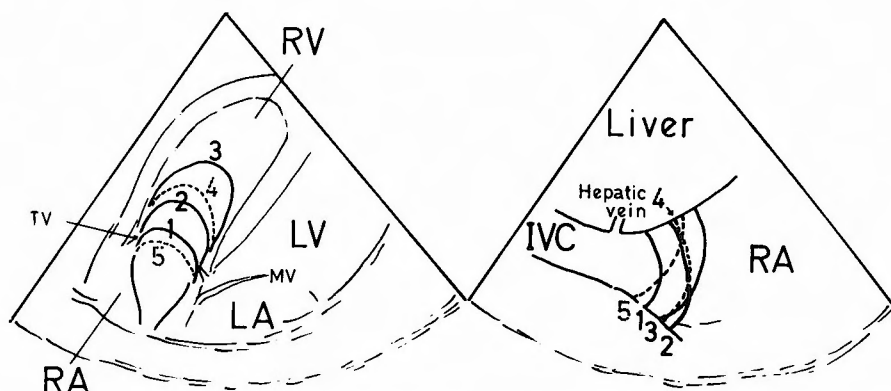
**Fig. 1.** Two-dimensional echocardiograms obtained from various approaches—xyphoid approach (1 and 2) and apical four chamber view (3 and 4). T: tumor, RA: right atrium, LA: left atrium, IVC: inferior vena cava, RV: right ventricle, LV: left ventricle



**Fig. 2.** M-mode echocardiograms show a group of multiple linear echoes similar to those seen in myxoma in the right atrium (1) and the outflow tract of the right ventricle (2). The motion of the interventricular septum is paradoxical with enlarged right ventricle and small left ventricle (3 and 4). PE: pericardial effusion, RA: right atrium, RV: right ventricle, LA: left atrium, IVC: interventricular septum, Ao: aorta, MV: mitral valve



**Fig. 3.** Size of the tumor on August 5, 1982 (1A and 1B) and on June 14, 1983 (2A and 2B). The intracardiac tumor echo was detected in the four chamber view (1A and 2A) and long axis view of the inferior vena cava (1B and 2B).



**Fig. 4.** Changes in size of the tumor observed by two-dimensional echocardiography on the following days: 1, 8-30-1981; 2, 6-3-1982; 3, 8-5-1982; 4, 11-30-1982 and 5, 6-14-1983.

RA: right atrium, RV: right ventricle, LA: left atrium, TV: tricuspid valve, IVC: inferior vena cava, RV: right ventricle, LV: left ventricle, MV: mitral valve

The tumor extending into the right ventricle through the tricuspid valve moved from the right atrium to the right ventricle on diastole, and returned to the right atrium on systole. Moreover, contrast echocardiography revealed slight tricuspid regurgitation.

### Discussion

In general, patients with renal cell carcinoma extending into the inferior vena cava have an extremely poor prognosis. However, the outlook for the patient with only venous extension of tumor without perinephric fat or regional node involvement is considerably better than has been previously thought. The 5- and 10-year survival rates of these patients are 55 and 43 per cent, respectively<sup>6)</sup>. In our case, however, regional node involvement and pulmonary metastasis were strongly suspected from the CT scan findings. In addition, extension into the right atrium was noted by echocardiography. Therefore, this patient was not suitable for the aggressive surgical approach, and instead, palliative surgery was performed, combined with local chemotherapy during surgery using anticancer emulsion.

Based on M-mode echocardiographic findings on intracardiac renal cell carcinoma, FAROOKI<sup>2)</sup> reported a patient with Wilms' tumor that extended into the right atrium via the inferior vena cava. MIZUSHIGE<sup>4)</sup> reported one case of renal cell carcinoma that extended into the right atrium, emphasizing some two-dimensional echocardiographic findings: 1) uniformity in echo strength, 2) clear contour of the tumor and 3) passage through tricuspid valve during the cardiac cycle.

Since the first operation, an intracardiac tumor and renal cell carcinoma in the renal region were observed by two-dimensional echocardiography and CT scan, respectively. Slight tricuspid regurgitation, also noted by contrast echocardiography, was similar to that found in presence of right atrial myxoma. The surface of the tumor was relatively smooth, suggesting the presence of a capsule. The tumor was attached to the inferior vena cava and extended to the right

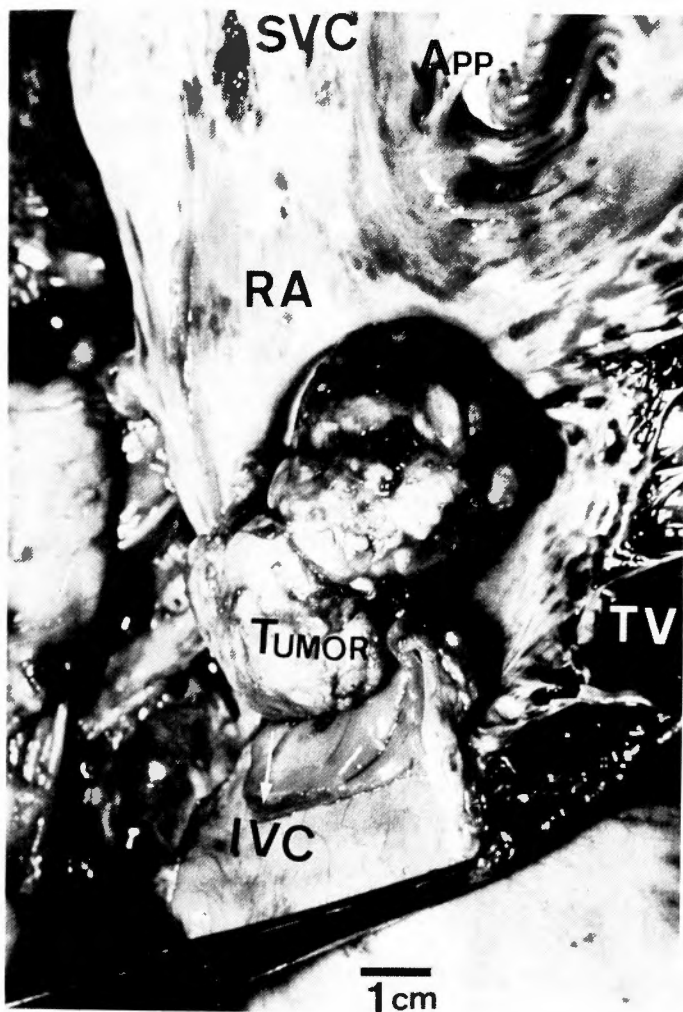


Fig. 5. Autopsy findings

SVC: superior vena cava, IVC: inferior vena cava, RA: right atrium, TV: tricuspid valve, App: right atrial appendage

atrium, where an unattached "L" shaped tumor passed through the tricuspid valve (Fig. 5).

Compared to the intracardiac tumor the new tumor in the left renal region grew very rapidly, becoming  $7 \times 8 \times 9$  cm in about one year. This suggests that there is a limitation in the growth of intracardiac renal cell carcinoma. In fact, as autopsy revealed, central necrosis was found in the top portion of the encapsulated tumor. Therefore, in some cases, extensive surgical intervention may not always be necessary for patients in whom total tumor resection is impossible.

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## 和文抄録

# 下大静脈を経て右房内へ伸展発育した 腎細胞癌腫瘍血栓の心エコー所見

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60歳, 女性, 右腎原発 Grawitz 腫瘍は, 下大静脈を経て右心房内に侵入, 最大時には, 拡張期に右心室の1/2を占めるまでに成長した。初回手術では, 腫瘍を含む右腎全摘出を行い, 下大静脈の腫瘍血栓はそのまま放置した。2回目手術では, 左副腎周囲の再発癌の

摘出を行なった。初回手術前から肺アスペルギルス症で死亡するまでの2年間, 心エコー法で心内腫瘍を追跡観察し得た。その心エコー所見及び大きさの変遷を報告する。